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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/800,493	03/08/2001	Hiroshi Moriya	500.3930X00	2194

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EXAMINER

QUINTO, KEVIN V

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 03/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/800,493	Applicant(s) MORIYA ET AL.	
	Examiner Kevin Quinto	Art Unit 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) 7-13 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3-5 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 6 and 14-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>2</u> | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 6, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marsh (USPN 6,323,511) in view of Schuele (USPN 5,760,474) and further in view of Wolf ("Silicon Processing for the VLSI Era, Vol. 2 – Process Integration," p.194-196).

3. In reference to claims 1, 2, and 6, Marsh (USPN 6,323,511) discloses a similar device. Figure 2 of Marsh illustrates a DRAM device having a first capacitor electrode (85), an oxide film (87), and a second capacitor electrode (88) on a substrate (7). The oxide film (87) between the two capacitor electrodes (85 and 88) is described as being an oxide in column 13, lines 46-52. Claim 21 of Marsh specifies the electrode material which meets the limitation of the claim. To be more specific, Marsh claims a capacitor electrode which has a composition where a major portion can be made of rhodium, ruthenium, iridium, and osmium while a minor portion can be made of palladium. The minor portion is also claimed to have an atomic percent of "about 10%" in claim 22 of Marsh. This is within the limitation of claim 6. It is understood that claims 21 and 22 of Marsh apply to the device shown in figure 2. Figure 2 of Marsh discloses an interlayer insulating film (83) made of an oxide which is in contact with first capacitor electrode (85). Marsh does not explicitly state that this oxide is silicon dioxide. However the use of silicon

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dioxide, an interlayer insulating film (with silicon as its main constituting element), as the poly-metal interlevel dielectric is well known in the art. Wolf ("Silicon Processing for the VLSI Era, Vol. 2 – Process Integration," p.194-196) discloses that silicon dioxide is a desired poly-metal interlevel dielectric because it has a low dielectric constant while providing good adhesion between other dielectric layers above and below it. It would therefore be obvious to use silicon dioxide, an interlayer insulating film with silicon as its main constituting element (83), which is in contact with the first capacitor electrode (85) in the device of Marsh. Marsh also does not disclose the use of an interlayer insulating film with silicon as its main constituting element over the second capacitor electrode. However the use of an interlayer insulating film with silicon as its main constituting element over the upper capacitor electrode is well known in the art. Schuele (USPN 5,760,474) discloses the use of a silicon dioxide layer, an interlayer insulating film (with silicon as its main constituting element), which is over the capacitor. Schuele does not disclose the reason behind using a silicon dioxide layer but this too is well known. Wolf ("Silicon Processing for the VLSI Era, Vol. 2 – Process Integration," p. 196) discloses that silicon dioxide provides good electrical and physical properties which is compatible with the presence of aluminum in the device. It would therefore be obvious to use silicon dioxide as the interlayer insulating film which is over the second capacitor electrode (88) in the device of Marsh.

4. In reference to claim 14, the process to fabricate the device of March in view of Schuele and Wolf meets this claim. Claim 14 discloses a process to form a device where both of the capacitor electrodes are in contact with an oxide capacitor dielectric film as well as an interlayer insulating film with silicon as its main constituting element. At least one of the capacitor

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electrodes has rhodium, ruthenium, iridium, and osmium as the main constituting material and an additional material of palladium. Claim 14 claims the fabrication process for the device of claim

1. As stated above, the device of Marsh in view of Schuele and Wolf meets claim 1, and thereby meets the fabrication process limitation of claim 14.

5. In reference to claim 15, the process to fabricate the device of March in view of Schuele and Wolf meets this claim. Claim 15 discloses a process to form a device where both of the capacitor electrodes are in contact with an oxide capacitor dielectric film as well as an interlayer insulating film with silicon as its main constituting element. Claim 15 claims the fabrication process for the device of claim 1 as well as an electroconductive film between the first capacitor electrode and the interlayer insulating film. Figure 2 of Marsh discloses the use of a titanium film (75) between the first capacitor electrode (85) and the interlayer insulating film (40). As stated above, the device of Marsh in view of Schuele and Wolf meets claim 1, and thereby meets the fabrication process limitation of claim 15.

6. So far as understood in claim 16, the process to fabricate the device of March in view of Schuele and Wolf meets this claim. Claim 16 discloses a process to form a device where both of the capacitor electrodes are in contact with an oxide capacitor dielectric film as well as an interlayer insulating film. At least one of the capacitor electrodes has rhodium, ruthenium, iridium, and osmium as the main constituting material and an additional element of palladium. The examiner believes that the main constituting element and the additional element in the capacitor electrodes of Marsh are *evenly distributed throughout the entire structure of the electrodes*. The device of Marsh therefore meets the limitation where "near the boundary of said insulating film, said first capacitor electrode or said second capacitor electrode includes a region

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containing an element selected from the group consisting of palladium, nickel, cobalt, and titanium.” Claim 16 claims the fabrication process for the device of claim 1. As stated above, the device of Marsh in view of Schuele and Wolf meets claim 1, and thereby meets the fabrication process limitation of claim 16.

Allowable Subject Matter

7. Claims 3-5 are allowed.
8. The examiner is unaware of any prior art which explicitly discloses a semiconductor device with a capacitor electrode that contains more ruthenium than an amount of nickel or titanium. The examiner is also unaware of any prior art which explicitly discloses a semiconductor device with a capacitor electrode that contains more ruthenium oxide or iridium oxide than an amount of palladium or nickel or cobalt or titanium.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (703) 306-5688. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

KVQ

March 24, 2002

Director
Patent Office